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Part III A.2.c

SECTION 1

GENERAL OPERATION PRACTICE

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General Operation Practice

1.1 Introduction

In the operation and maintenance of boilers certain basic practices are followed to achieve maximum economic use of the plant. The operators must completely familiarize themselves with the various features of a particular installation by observing, recording, checking data and procedures, studying the information given in this manual and the manuals of the auxiliary equipment suppliers. The information given is general in nature to provide the operators with guidelines for overall effective safe operation. Emergency situations, leading to outages & repairs unsafe operating conditions can be avoided by a proper working knowledge and attention on the part of the operators.

The following information is intended as a guide to the operators and must be augmented with a complete study of all the equipment suppliers and manufacturers instruction manuals, data sheets and drawings. The operators must become fully conversant with proper operation procedures and most important of all the safety at all times of people and equipment.

All steam generating plants need operators. Any control system can be changed from automatic to manual control therefore to be effective the operator must know what he is doing, why it is being done and what will be the result of his actions.

All steam plants are designed for a specific purpose in this case the recovery of energy by the burning of municipal garbage to generate steam at the required pressure and temperature when supplied with feed water at the specified temperature to drive a turbine generator. Operating at conditions outside and above the design parameters shortens the life of the boiler and its components.

1.2 Steam Output and Boiler Efficiency

The quantity of steam generated and the pressure and temperature is dependant on the quantity of fuel burned, its calorific heating value and the amount of excess air. The equipment for feeding the refuse to the grate, the grate, the combustion control and instrumentation system and ash handling system are all supplied by others. However, the boiler designer is directly concerned with all these items in the design and operation of the boiler.

The calorific value of the municipal garbage can vary considerably and the boiler operator must be aware of this. The combustion control system is automatic and computerized and although operating characteristics will be set by the equipment and the type of fuel fired, the operator must be fully knowledgeable of the causes of any change which results in variations in economizer gas exit temperature, O_2 or CO_2 (excess air) in the flue gas, fuel combustion analysis (CO for example) which may be to the detriment of the boiler performance and efficiency so that the cause of the change can be determined and the boiler performance restored to the required specified conditions.

The combustion process operating requirements will be covered by the Martin GMBH grate operating instruction manual. These instructions will include how the fuel fed to the boiler is regulated, the control of the combustion air supply via the forced, overfire and seal air fans, the control of the reciprocating grate and its air zones. The aim being to achieve as complete as possible combustion of the fuel on the grate at an excess air rate between 90 to 110 percent.

The Martin GMBH and the OMS instruction manuals must be referred to for a complete study of the combustion operating process.

1.3 Steam Temperature and Control

The superheater is sized to give the specified superheated steam temperature at the required outputs over a given control range. This allows flexibility of the steam plant to operate at various loads with a constant steam temperature to the turbine maximizing the steam cycle efficiency over the load range. Control of the steam temperature is by means of two spray desuperheater one fitted between the primary and intermediate superheater and the other fitted between the intermediate and finishing superheater.

1.4 Steam Quality

Dry steam containing minimum total solids (in this case 0.5 ppm) is achieved by the use of separators and driers located in the steam drum. The quality of the saturated steam is dependant on the quality of the feedwater and the water inside the boiler. A water chemical analysis/water treatment program must be implemented from the very beginning of the operation of the steam plant. The benefits are manifold over the lifetime of the plant minimizing internal tube corrosion and deposits, avoiding problems in the superheater internal surfaces and in the steam turbine blading. Operators must continually monitor feed water and boiler water conditions as well as taking steam samples to avoid costly repair shutdown periods. (See Section 2.4 of this manual).

1.5 Cleaning of External Heating Surfaces

Heating surfaces will become fouled over time as the boiler is operated. Daily cleaning is by the use of soot blowers. The number of times a day is determined by experience from the rise of the economizer gas exit temperature, the increase in gas draft loss and a change in the steam temperature control system. Accurate records kept from the beginning of operation when the unit was in clean condition will enable comparisons to be made on a daily basis to determine the number of times the sootblowing cycle should be implemented. (See Section 2.11 of the Manual). Cleaning is also carried out when the unit is shut down for scheduled inspections, etc.

1.6 Start-Up

When starting up a boiler the unit should be inspected to ensure all doors, inspection openings are clear of safety tags and shut; valves are in their correct open or shut positions; the boiler is filled with water; fuel is available, natural gas for the auxiliary burners and refuse for main firing;

feed chutes, feeders, grate and ash system are in proper working order and ready; fans and motor drives checked; combustion controls and instrumentation checked; ALL SAFETY CONTROL SYSTEMS operational; a furnace purge must be initiated prior to light off; during the warm-up period vents will be open until there is a continuous flow of steam and then closed; the gas temperature to the superheater kept below 1,000°F until steam flow is established. The time required to bring a boiler on line is limited to 100°F per hour of saturated steam temperature to allow inspection of expansion movements and clearances and to avoid any local over-heating of any of the boiler components.

1.7 Water Level

The water level should be checked by blowing down the water gage glass. The most serious emergency is loss of water to the boiler. The water level must be monitored continuously and the water column and gages inspected regularly. Low water level is indicative of a problem with feed water supply, the control system, tube failure or some other cause and must be acted upon immediately. If the water level disappears from the glass, except in the case of momentary fluctuations which might occur with extraordinary changes in load, appropriate action should be taken to extinguish the fire and stop feeding the fuel. Reference should be made to the Martin GMBH and Ogden Martin Systems instruction manuals in this instance.

1.8 Blowdown

The boiler blow down system is provided to limit the total dissolved solids and/or silica in the boiler water to remove any sludge resulting from the water treatment and should be used when the unit is operating at low fuel firing rates and low steam outputs. The frequency and duration of blowdowns are dependant on the chemical analysis of the boiler water. Water treatment plants and programs vary from plant to plant to suit local conditions. A responsible water analysis specialist should determine a suitable water treatment program from the water analysis and give the necessary instructions for blowing down. A continuous blowdown system is located in the steam drum for use at higher boiler outputs.

As well as solids concentration in the boiler water oxygen concentration in the feed water must be regulated to minimize the formation of corrosion products and the boiler water PH must be controlled with minor deviations from the recommended limits. Large deviations can lead to severe corrosion problems.

1.9 Shut Down

Shut down of the boiler depends upon whether the unit is to be completely shut down for a scheduled internal inspection or repair or to be maintained in a hot stand-by condition. Under normal conditions the unit should be cooled down at a rate not to exceed 150°F per hour of saturated steam temperature; the drum vents opened at 25 psig and the boiler drained (if so desired) when the water temperature is below 200°F.

1.10 Lay Up

When the boiler is shut down for stand-by for short periods or taken out

of service for long periods, precautions must be taken against corrosion. There are two methods, one "Dry" one "Wet" to protect the water side of the pressure parts. (See Section 2.21 of the Manual).

1.11 Training - Maintenance

An effective approach for ensuring good economic steam boiler plant operation is to have two on-going programs one for continually updating and training operators and the other a well planned inspection and preventive maintenance program. Such an approach will avoid shut downs caused by poor operation as well as minimizing expensive maintenance repairs and down time.

Conclusion

There are many aspects of boiler operating practice other than the foregoing. Any additional information will be provided on request to Distral Energy Corporation. Please refer to Section 2 of this manual for more detailed information.